MULTIMEDIA UNIVERSITY

STUDENT ID NO

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 3, 2021/22

ERA2036 – INTRODUCTION TO ARTIFICIAL INTELLIGENCE

(All sections / Groups)

5 OCTOBER 2022
9:00 a.m. – 11:00 a.m.
(2 Hours)

INSTRUCTIONS TO STUDENTS

1. This Question paper consists of 4 pages including cover page with 4 Questions only.

2. Attempt **ALL** questions. All questions carry equal marks and the distribution of the marks for each question is given.

3. Please print all your answers in the Answer Booklet provided.

Question 1

(a) Machine learning is a branch of artificial intelligence (AI). Draw TWO diagrams to compare the differences between classical programming and machine learning and explain their differences. [8 marks]

(b) Preventive maintenance is scheduled, routine maintenance to keep equipment running as well as prevent downtime and expensive repair costs. Discuss how preventive maintenance is done traditionally and how it can be improved by leveraging AI. [8 marks]

(c) While AI can be used to solve problems, there are risks incurred from the misuse of AI.

i. Identify and briefly discuss TWO of these risks. [5 marks]

ii. To reduce the risks due to the misuse of AI, some organizations have defined guiding principles for responsible AI. Identify and describe TWO of these guiding principles. [4 marks]

Question 2

(a) There is an $n \times n$ grid of squares, each square initially being either dirty floor or a wall. You start standing on a dirty floor square and can either clean the square under you or move onto an adjacent dirty floor square. You want the whole floor clean. Give a complete formulation for this problem by providing the initial state, goal state, available actions and cost function. [8 marks]

(b) Represent the graph in Figure Q2(b) by using a Python dictionary. [6 marks]

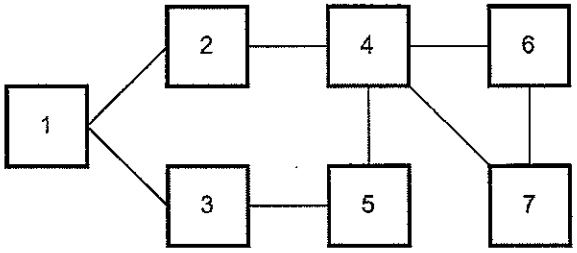

Figure Q2(b)

(c) If the initial state is 1 and the goal state is 7, provide the shortest path from the initial state to the goal state for the graph in Figure Q2(b) if each edge has the same cost. [3 marks]

(d) For the maze shown in Figure Q2(d), the player (☺) can move in four directions only, according to this priority order of movement: Up (U), Down (D), Left (L) and Right (R). The player cannot move into a block that it has previously visited. Using depth-first search (DFS) algorithm, generate a tree until the goal state (☆) is reached.

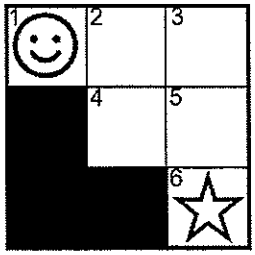

Figure Q2(d) [8 marks]

Continued...

Question 3

(a) Using propositional logic, complete and reproduce the truth table in Table Q3(a) in your answer booklet. [6 marks]

TableQ3(a)

P	Q	$\neg P$	$P \vee Q$	$P \wedge Q$
False	False			
False	True			
True	False			
True	True			

(b) Consider a vocabulary with only three propositions: A, B and C. How many models are there for the following sentences?

i. $A \vee B$ [3 marks]

ii. $\neg B \wedge \neg C$ [3 marks]

iii. $(A \wedge B) \vee (B \wedge C)$ [3 marks]

(c) Draw a flowchart to depict the general workflow in developing a machine learning system. [6 marks]

(d) Discuss the main difference between supervised and unsupervised learning. [4 marks]

Continued...

Question 4

(a) Describe TWO types of supervised learning and explain the operations involved in each type. [4 marks]

(b) k-nearest neighbour (k-NN) is often used as the baseline technique in machine learning.

i. Explain how k-NN can be used in classification. [4 marks]

ii. Describe TWO hyperparameters in k-NN. [4 marks]

(c) As an AI engineer, you are required to analyse the Python script in Code Listing Q4(c) and perform the following tasks:

i. If there are 600 samples in the dataset, how many samples are used for training and testing? [4 marks]

ii. Complete the Python code in Code Listing Q4(c) to build a k-NN model for classification using the training samples and evaluate its accuracy using the testing samples. Build the k-NN model with 3 nearest neighbours and use the default values for other hyperparameters. [4 marks]

```
from pandas import read_csv
from sklearn.model_selection import train_test_split as split
from sklearn.neighbors import KNeighborsClassifier
df = read_csv("mydata.csv")
dataset = df.values
X = dataset[:,:4]
y = dataset[:,4]
X_train, X_test, y_train, y_test = split(X, y, test_size=0.25)
```

Code Listing Q4(c)

(d) Table Q4(d) is a dataset of houses with sizes (in square meters) and rentals (in Malaysian Ringgit):

Table Q4(d)

	Size (s)	**Rental (r)**
House 1	100	200
House 2	200	475
House 3	200	400
House 4	250	520
House 5	325	735

A linear regression model has been trained to predict the rentals of the houses based on their sizes as follows:

$$\hat{r} = 2.5s - 35$$

Calculate the predicted rental of each house in Table Q4(d) by using this linear regression model. [5 marks]

End of Paper